

MST204 Errata 1998

The following errata in course texts were notified to us in 1982–199. Some of these errata may already have been corrected in your copies if they are reprints. Note that a line which is n lines up from the bottom of a page is referred to as “line $-n$ ”.

Course Guide

Page	Location	Correction
page 1	line -6	Replace “the substitution rule” by “substitution”.

Handbook

Page	Location	Correction
		Please delete the following entries from the Index in Section 9 pages 56–60: constraint, degeneracy of linear programming problem, feasible region, graphical method, linear programming problem, objective function, optimal vertex, optimum, simplex method and trivial constraint.
page 54	Section 2, item 1, line 4	This should read $K = \frac{k}{l_0}$. <i>It is important that you correct this error in your Handbook since the Handbook may be taken into the Examination.</i>

Unit P

Page	Location	Correction
page 12	Frame 1	Replace “ a^2 ” in the <i>second</i> cloud by “ a^{-2} ”.

Unit M

Page	Location	Correction
page 20	line 2	This should read “ $a = \frac{-u_i^2}{2s_i}$ ”.
page 46	column 2, line 15	This should read “ $\dots = \left(\frac{1 - e^{aT}}{M} \right) P_{n+1} + (e^{aT} - 1)$ ”.
page 48	line above Figure 6	This should read “... between $\sqrt{2h/g}$ and ...”.

Unit 1

Page	Location	Correction
page 3		The page reference for Subsection 2.3 should be 22.
page 8	Exercise 1(i)	The equation should read: " $u_{r+1} = \frac{1}{2}(u_r + u_{r-1})$ ".
page 29	line -1	The equation should read: " $u_{r+1} = (r+1)u_r - 1$ ". (Note also the errata indicated below for the Solution to Exercise 3 on page 53.)
page 34	bottom diamond of flow chart	Replace "=" by " \simeq ".
page 41	table at bottom	Insert "?" after the heading "constant-coefficient".
page 43	line 7	Replace "Student Computing Service Student's Guide" by "correspondence texts for the relevant units, but".
page 47	line -12	Replace " $2/yx$ " by " $2/(yx)$ ".
page 53	column 2, Solution to Exercise 3	This solution should start as follows: "If we start with $\bar{u}_{r+1} = (r+1)\bar{u}_r - 1,$ then subtracting the original recurrence relation gives $\begin{aligned}\bar{u}_{r+1} - u_{r+1} &= (r+1)(\bar{u}_r - u_r) \\ &= (r+1)r(\bar{u}_{r-1} - u_{r-1}) \quad \text{using } \bar{u}_r - u_r = \\ &\quad r(\bar{u}_{r-1} - u_{r-1}) \\ &\vdots \\ &= (r+1)!(\bar{u}_0 - u_0).\end{aligned}$ Putting $n = r+1$ we have $\bar{u}_n - u_n = n!(\bar{u}_0 - u_0).$ Hence the scale factor is $n!$ and the problem is absolutely ill-conditioned for large values of $n \dots$ ".
page 54	Solution to Exercise 8	The first entry in the right-hand column of the table should be "-1.7182819".
page 56	Solution to Exercise 5(i)	The first entry in the right-hand column of the table should be "0.13888889".
page 57	Solution to Exercise 6, second table	The value of u_9 should be "0.04616448" (i.e. delete the minus sign).
page 57	Solution to Exercise 6, second line after second table	Replace " u_8 " by " u_9 ".
page 57	Solution to Exercise 1	Insert "?" after the heading "homogeneous".
page 57	Solution to Exercise 5	The numbers in the left-hand column of the table should run from 0 to 5 rather than from 1 to 6.
page 58	table in column 1	Same erratum as above.
page 58	table in column 2	The numbers in the left-hand column should run from 10 to 5 (downwards) rather than from 1 to 6.

Unit 2

Page	Location	Correction
page 45	column 2, line 14	This should read " $\frac{dy}{dx} = \frac{1}{\arctan x + C} \times \frac{1}{1+x^2} = \frac{1}{e^y} \times \frac{1}{1+x^2}$ ".
page 48	column 1, Solution to Exercise 6(iii), line 5	Replace "5(iv)" by "5(iii)".
page 50	Solution to Exercise 1(ii), line 1	This should read "The response to Option 35 should be changed to 500; the response to Option 36 becomes 0.002. Option 41 is".

Unit 3

Page	Location	Correction
page 9	line 4 of Subsection 1.2.	Please delete the phrase "rather than from 0AD".
page 14	Subsection 1.5, line 8	Replace "Figure 1" by "Figure 2".
page 23	table	The entry in the $\log_e \left(\frac{M}{P} - 1 \right)$ column for 6 hours should be "1.030" rather than "1.050".
page 25	Assumption (2) in the box	Replace by: "That the proportionate growth rate $\frac{1}{P} \frac{dP}{dt}$ decreases linearly as P increases."
page 42	Section 5	Delete the second paragraph, which starts "Problem 4 is rather different ...".
page 47	Solution to Exercise 4(i)	This should start: "Equation (6) is the solution to the logistic equation rearranged in the form ...".
page 48	Solution to Exercise 7, line 5	Replace "increase" by "increases".
page 51	column 1, line -1	Replace " $f'(a)$ " by " $f'(0)$ ".
page 53	column 1, line 10	Replace "sustainable" by "sustainable".
page 53	Solution to Problem 1 of Section 5	Alter the first 8 lines as below: 1(i) "Suppose that the population is P_n in the autumn of the n th year. Denote by B_n the births in n th year and by D_n the deaths between the autumn of the $(n-1)$ th and autumn of the n th year. Then $P_{n+1} - P_n = B_{n+1} - D_{n+1}.$ Now from the assumptions given $B_n = B,$ $D_{n+1} = dP_n,$
page 54	column 1, line 8	Insert "autumn" before "1970".
page 54	column 1, line 9	Replace "during 1970" by "between autumn 1970 and autumn 1971".
page 54	table in column 1	The heading of the fourth column should read "Deaths (D_{n+1}) (hundreds)".
page 56	column 2, line -11	Replace "151" by "157".

Unit 4

Page	Location	Correction
page 49	Solution to Exercise 6(i), line 2	Replace "chain" by "product".
page 57	column 2, lines -2 and -4	Replace " wx " in both cases by " ωx ".

Unit 5

Page	Location	Correction
page 21	second entry in margin	This reference to polar coordinates should read: "M101 Block VI Unit 1 and MS283 Block II Unit I".
page 26	line -9	Replace "-" by "=" at start of line.
page 27	line 1 of Section Summary	Replace "representation" by "form".
page 28	line -12	This should read "come across them in M101, MS283 or Unit P of this course.)".
page 32	line below Exercise 6	Insert "the equation" at the end of the line.
page 42	margin, line -3	This should read " $\overline{z_1 + z_2} = \overline{z_1} + \overline{z_2}$ ".
page 42	line -1	Replace " α^n " by " $\overline{\alpha}^n$ " in the first term of the equation.
page 44	line -13	Replace "Movire's" by "Moivre's".
page 45	figure	The annotation on the upper and lower curves should read " $y = 2^{n/2}$ " and " $y = -2^{n/2}$ " respectively.
page 52	column 1, line -3	should read "(vi) Although ...".
page 53	column 1, line 1	Replace "fourth" by "third".

Unit 6

Page	Location	Correction
page 20	last line of Procedure 2.2(a) box	This should read " $y = X \cos \omega t - Y \sin \omega t$ ".
page 25	Example 10, line 2	Replace "... +4 = ..." by "... +4y = ...".
page 25	Example 10, line 5	Insert ")" before the full stop.
page 26	first column of table	Replace " ke^α " by " $ke^{\alpha x}$ ".
page 36	caption to Figure 1	Replace " t " by " x " in the equation.
page 36	in margin opposite table at bottom of page	Please insert "This table is only valid if the coefficient of y (that is ω^2) is positive".
page 38	Equation (7)	The left-hand side of the equation should read: " $\frac{d^2 y}{dx^2} + 4 \frac{dy}{dx} + 5y$ ".
page 40	last two lines of Exercise 4	Replace " t " by " x " (twice).
page 45	table	The right-hand heading should read " $-0.6y_r + 1.5z_r$ ".
page 47	Exercise 2(i)	Replace " $\frac{d^2 y}{dx^2}$ " by " $\frac{d^2 y}{dt^2}$ ".
page 53	column 2, line 5	This should read " $u(t) = A \sin 2t + B \cos 2t$ ".
page 54	column 2, line 1	Delete one "u" from "solutions".
page 55	Solution to Exercise 2, line -1	should be "... provided $\alpha^2 - \omega^2 \geq 0$ ".
page 56	Solution to Exercise 10, line 2	Replace " y " by " x ".
page 56	Solution to Exercise 11, line 1	Replace " y " by " x ".
page 57	Solution to Exercise 2, line 2	Replace " z_{r-1} " by " z_{r+1} ".
page 58	column 2, line -5	Replace " $\frac{d^2 y}{dy^2}$ " by " $\frac{d^2 y}{dt^2}$ ".
page 59	column 2, line 10	Replace " $\frac{dy}{dx}$ " by " $\frac{dy}{dt}$ ".
page 60	column 1, line -2	Replace " $e^{-\frac{1}{2}c}$ " by " $e^{-\frac{1}{2}t}$ ".
page 60	Solution to Exercise 5	This should start: "If $\lambda \neq 0$ the general solution of the differential equation is ...". Replace the last line by: "This occurs if λ is a (non-zero) integer. If $\lambda = 0$ then the general solution is $u(x) = Ax + B.$ Hence $u(0) = B = 0$ and $u(1) = A + B = 0$, and so $u(x) = 0$ is the only solution to the boundary condition problem. We conclude that the problem has a solution other than the zero function if and only if λ is a positive or negative integer".

Unit 8

Page	Location	Correction
page 24	Section Summary, line 3	The equation should read " $m\ddot{x} + r\dot{x} + kx = P \cos \omega t$ ".

Unit 9

Page	Location	Correction
page 9	line 12	Replace " $-(2 \times 2)$ " by " $-(3 \times 2)$ ".
page 11	Solution to Example 6, Stage 1(b)	The last row of the matrix should be labelled R_{3b} , and not R_{3a} .
page 29	line 2 of box	Replace "large changes in the solution." by "changes in the solution which are significantly larger in magnitude."
page 40	line 2	Replace the entry "1.41" at top left of the matrix by "-1.41".
page 41	line 3	Replace "large' changes in the solution." by "changes in the solution which are significantly larger in magnitude."
page 47		Delete Exercise 5.
page 50	line -1	Please insert " E_3 " opposite the equation.
page 53	Solution to Exercise 7(i), Stage 1	Replace " R_2 " to the right of the matrix by " R_{2a} ".
page 53	Solution to Exercise 7(ii), Stage 1	Insert " R_1 " and " R_{2a} " to the right of the first and second rows respectively of the matrix.
page 57	Solution to Exercise 4	Replace "Option (a) is wrong because ... undesirable!" by "Option (a) is wrong because multipliers may be equal to 1".

Unit 12

Page	Location	Correction
page 8	margin, line below Figure 1	Replace "were" by "we".
page 21	Equation (5)	The left-hand side should read: " $2hl(\theta - \theta_a)\delta x$ ".
page 21	line below Equation (5)	Replace "square" by "curly".
page 21	fourth line below Equation (5)	Replace "=" by " \simeq ", and delete "+ ..." at the end of the line.
page 21	Equation (6) and the equation two lines above	Delete "+ ..." (twice).
page 21	line below Equation (6)	This should read: "The sign " \simeq " refers to approximations ...".
page 23	Figure 6	The numbers at the extreme right-hand edge, labelling the five solid curves, have been omitted. These numbers are (in $^{\circ}\text{C}$, reading downwards) 33, 22, 16, 11, 6.
page 25	Exercise 6	Please note that the curves relate to the air-gap between <i>glass</i> -plates. Please add "The air temperature on one side of the wall is 21°C and on the other side the air temperature is 0°C ".
page 27	Solution to Exercise 4 of Section 2, lines -7, and -5	Replace "69.1" by "69".

Unit 14

Page	Location	Correction
page 9	line -4	Replace "represents:" by "represents the velocity of:".
page 12	third line above box	Replace "displacment" by "displacement".
page 13	Summary of Section 1, item 1	This should start: "A non-zero vector ...".
page 26	Exercise 7, line 3	Delete " \mathbf{u} ".
page 32	Frame 2	Replace " D " by " D' ".
page 39	Figure 8	Replace "Path of P varies as t varies" by "Path of P as t varies".
page 40	Example 5, line 1	Replace "... is zero" by "... is the zero vector".
page 42	line -10	Replace "... and $v = \dots$ " by "... and $\mathbf{v} = \dots$ ".
page 50	Solution to Exercise 4, line 3	Replace " i " by " \mathbf{i} ".

Unit 15

Page	Location	Correction
page 8	Frame 2	Please do not confuse the symbol "z" for "3".
page 9	Frame 4c	This is once referred to erroneously as Frame 3d on the audio-tape.
page 47	Solution to Exercise 1(ii), lines -6, -5 and -4	Replace " \geq " by ">" (three times).
page 50	Solution to Exercise 5(i)	Delete the first two sentences: "Some care is needed here ... rather than to L".

Unit 18

Page	Location	Correction
page 10	second line after Figure 2	Replace " $\dots + \frac{1}{6}(x+1)^3$ " by " $\dots + \frac{1}{6}(x-1)^3$ ".
page 23	Frame 3, line after the figure	Replace "... Taylor polynomial about 0 ..." by "... Taylor polynomial about 0.1 ...".
page 28	line 3	Replace "derivative" by "derivatives".
page 47	Summary of Section 4, item 2, line 3	Replace " $\dots, (x_n, f(x^n)), \dots$ " by " $\dots, (x_n, f(x_n)), \dots$ ".
page 53	Solution to Exercise 5, line 1	The end of this line should read: "... for the integral of e^x ...".

Unit 19

Page	Location	Correction
page 16	four lines above Example 1	This should start: "and Y_1' depends on Y_1 ".
page 19	Step 2 (iii) of the Procedure Box for the predictor-corrector method.	This should read: "Evaluate $Y_{r+1}' = m(x_{r+1}, Y_{r+1}^*)$ ".
page 33	line 1	Replace "small" by "low".
page 42	line -14	Replace "first-order recurrence relation" by "first-order differential equation".
page 53	column 1, Solution to Exercise 5, line -3	This equation should read: $Y_{r+1} = Y_r + \frac{h}{2}[m(x_r, Y_r) + m(x_{r+1}, Y_r + hm(x_r, Y_r))].$
page 53	column 2, Solution to Exercise 4, line 2	Same erratum as above.
page 53	column 2, Solution to Exercise 4, line 4	The right-hand side of this equation should read: $\frac{1}{2}[m(x_r, Y_r) + m(x_r + h, Y_r + hm(x_r, Y_r))].$

Unit 20

Page	Location	Correction
page 15	second line after Equation (3)	Replace "that that" by "that".
page 19		Delete all the text on this page after the boxed equation.
page 25	Frame 9, diagram (b)	Replace " P' " by " P " and replace " P " by " P' ". (The coordinates of the two points remain unchanged.)
page 29	Step 1, line 2	Replace "The α ..." by "Then α ...".
page 37	line 1	Replace "... $ad - bc \neq 0$..." by "... $ad - bc = 0$...".

Unit 21

Page	Location	Correction
page 4	line -1	Replace "Section 6" by "Section 5".
page 10	line -6	This should read "section, the characteristic equation ...".
page 11	line 3	Replace "two roots" by "three roots".
page 12	line 9	Replace " $\begin{bmatrix} 1 & 1 \end{bmatrix}^T$ " by " $\begin{bmatrix} 1 & -1 \end{bmatrix}^T$ ".
page 13	line -10	This should read "with n real distinct eigenvalues. We ...".
page 14	line -13	Replace " x " by " x " (three times).
page 24	line 1	Replace " y " by " y'_2 ".
page 24	Exercise 5, line 2	Replace "... nearest to its ..." by "nearest to 2 and its".
page 29	third line above the box	Replace " $ac + d = 5$ " by " $ac + d = 4$ ".
page 30	line -4	Replace " AB " by " BA ".
page 31	line 6	Replace "... any square matrices ..." by "... any non-singular square matrices ...".
page 31	last sentence before Theorem 1	Replace "Thus we have derived the following theorem." by "Thus we have derived the following theorem for the case when both A and B are non-singular matrices (the theorem actually applies more generally than this).".
page 31	Theorem 1(ii)	This should read: "If x is an eigenvector of AB and B is non-singular then Bx is an eigenvector of BA ".
page 33	line -4	The reference should be to Equation (4) of Subsection 3.1.
page 34	line 6	Again the reference should be to Equation (4) of Subsection 3.1.
page 34	line 8	Should read " $A_2 = U_1 L_1 = \dots$ ".
page 34	line -15	Replace "... approximately diagonal ..." by "... approximately upper triangular ...".
page 36	item 3(v), line 1	Replace "... with eigenvalues ..." by "... with distinct eigenvalues ...".
page 37	Subsection 4.1, first line after the matrix	Replace "Subsection 4.3" by "Subsection 4.2".
page 37	lines -9 and -8	The numbers "33" and "6" should be underlined.
page 47	column 2, line 3	Replace " $\lambda_n = q$ " by " $\lambda_n + q$ ".
page 48	Solution to Exercise 5, line -4	Replace "... 4.412 and 1.588 ..." by "... 4.414 and 1.586 ...".

Unit 22

Page	Location	Correction
page 7	line 5	This should read "... written in matrix form,".
page 20	line -5	Replace "solution" by "solutions".
page 21	line -13	Replace "1:3" by "3:1".
page 22	box for Theorem 1, line -1	Replace " $(c_r + d_r t)$ " by " $a_r(c_r + d_r t)$ ".
page 25	line 4 of Section Summary	Replace "eigenvectors" by "eigenvalues".
page 30	Exercise 1(i)	The second equation should start " $\dot{x}_2 = \dots$ ".
page 35	column 2, line 11	Replace "corresonding" by "corresponding".
page 39	column 1, line 8	Delete "(" before "det".
page 39	column 2, line -2	This should begin "(Here $X_r = \dots$ ".
page 40	column 2, line -6	Insert "1" for the matrix entry in the first row and second column.

Unit 24

Page	Location	Correction
page 11	line 2	This should read "... model shown in Figure 4 on page 8 are $m_A = \dots$ ".
page 12	line 7	Replace " $x_A(t)/x_B(t)$ (for $x_B(t)$ non-zero)" by " $x_B(t)/x_A(t)$ (for $x_A(t)$ non-zero)".
page 12	Figure 5(a)	Replace the annotation " $-\phi_A = -\phi_B$ " by " $\phi_A = \phi_B$ ".
page 16	line 9	Replace "sunusoid" by "sinusoid".
page 18	line 4	This line should read " $x_B = R_1 A_1 \sin(\omega_1 t + \phi_1) + \dots$ ".
page 19	Figure 2	Replace the annotation " k_B " to the left of the <i>top</i> spring by " k_A ".
page 33	column 2, Solution to Exercise 1, lines -2, -1	Replace " $-\frac{m_B}{m_A}$ " by " $-\frac{m_A}{m_B}$ " (twice).
page 34	column 1, line -3 and column 2, line 2	Replace "9.45" by "9.46".

Unit 25

Page	Location	Correction
page 10	Example 3	This should start: "Determine the first-order partial derivatives of the following functions at (x, y) or at (x, t) as appropriate:".
page 13	second and third lines below Equation (7)	Replace "... the factor $(y - b)$ in (6), ..." by "... the factor $(x - a)$ in (5), ...".
page 20	Equation (21)	Replace " $h(x, t)$ " by " $h(x, y)$ ".
page 32	Frame 1, line 2	Replace " $\partial(x, y)$ " by " $f(x, y)$ ".
page 34	Frame 8, first column of table	Replace " $(0, 3)$ " by " $(0, 1)$ ".
page 35	last four lines	Replace by the following: "We know that $B \neq 0$, since $AC - B^2 < 0$ and $A = 0$. Therefore we can write
		$\frac{\Delta}{B} = \delta y \left(\delta x + \frac{1}{2} \frac{C}{B} \delta y \right).$
		Now Δ/B is positive for $\delta y \neq 0$, $\delta x = (1 - \frac{1}{2}C/B) \delta y$ and negative for $\delta y \neq 0$, $\delta x = (-1 - \frac{1}{2}C/B) \delta y$. So again we have a saddle-point".
page 37	Exercise 6, line 1	Replace " $(1, -1, -3)$ " by " $(1, -1, -2)$ ".

page 24 line 12 should read: $p_2(x, y) = p_2(a, b) + A(x-a) + B(y-b) + c(x-a)^2$

Unit 26

Page	Location	Correction
		The vertical rules for boxes have been omitted on pages 6, 8, 12, 33, 34, 38, 39 and 41.
page 7	Figure 6	The circular contours for $\phi = 0.25$ and $\phi = 2.25$ should have radii 0.5 and 1.5 respectively.
page 8	Figure 8	The positions of annotations " $I = 4$ " and " $I = 9$ " should be reversed. The radius of the outer sphere should be $1\frac{1}{2}$ times that of the inner sphere.
page 17	line -6	Replace " $z = \frac{1}{2}gt^2 + \dots$ " by " $z = -\frac{1}{2}gt^2 + \dots$ ".
page 19	line 3 of the Solution to Example 2	This line should read: "For $y > 0$ we have $y = b\sqrt{1-t^2}$ and for $y < 0$ we have $y = -b\sqrt{1-t^2}$ ".
page 19	Subsection 3.3, lines 12 and 14	Replace "=" by " \simeq ".
page 36	line 20	Replace " $F_1\left(x_0, y - \frac{l}{2}\right)h$ " by " $F_1\left(x_0, y_0 - \frac{l}{2}\right)h$ ".
page 38	line 5 of Box	Replace " $\lim_{A \rightarrow 0} \oint_C \mathbf{F} \cdot d\mathbf{r}$ " by " $\lim_{A \rightarrow 0} \frac{1}{A} \oint_C \mathbf{F} \cdot d\mathbf{r}$ ".
page 38	line -1 of Box	After "(see Figure 9)." insert the following: "The direction of integration round C is chosen so that a screw turned in this direction advances along \mathbf{n} ."
page 41	line 4	Replace "Exercise 5(ii)" by "Exercise 6(ii)".
page 42	lines 1, 2	Replace " $(2xy - 1)\mathbf{k}$ " by " $2xy\mathbf{k}$ " (twice).
page 44	column 1, Solution to Exercise 1	After the first sentence, this should read: "But $T = 100$ when $r = 4$; so by putting $T = a \log_e r$ we get $a = 100/\log_e 4$. Thus the scalar field function is ...".

Unit 27

Page	Location	Correction
page 18	line 2 of Part 5	Replace "indentical-looking" by "identical-looking".
page 31	line -8	This should start: " $= \left[-\frac{1}{3}(a^2 - x^2 - y^2)^{3/2} + \dots\right]$ ".

Unit 31

Page	Location	Correction
page 26	Appendix 2, column 1, line 2	Replace "The graph is symmetric about the t -axis ..." by "The graph is symmetric under a rotation about the origin through an angle π ...".
page 30	line 9	This should start " $f(t) = -\frac{8K}{\pi^2}(\cos \omega t + \dots)$ ".

Unit 32

Page	Location	Correction
page 38		The sentence "This is the solution to Problem 3(iii)." should appear as line -5 rather than as line 3.

